REMARKS

Claims 1-10 are pending.

The objections to the disclosure and claims have been obviated by amending the disclosure/claims to correct the informalities and errors noted by the Examiner.

Claims 1, 2, and 5 were rejected under 35 U.S.C. § 102(b) as being clearly anticipated by Babacz, U.S. Pat. No. 5,234,723 (hereinafter "Babacz '723"). This rejection is respectfully traversed and reconsideration is requested for the reasons that follow.

The present invention is directed to a chamber cleaning gas and method of use therefor to remove reaction byproducts (such as silicon, polysilicon, tungsten, titanium and their oxides, nitrides and carbides) attached to the walls of the chamber of a semiconductor integrated circuit production device. The inventor has discovered that

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CF3CF=CF2, CF3 CF-CF2 and CF3 C=0
                \  /             |
                 0              CF3
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may be utilized in a chamber cleaning gas in place of perfluoro compounds. The chamber cleaning gas of the invention is highly effective, but does not have the negative drawback associated with perfluoro compounds which create a global warming effect.

The examiner contends that Babacz '723 anticipates the present invention because it discloses a gaseous mixture of CF_3CFCF_2 (hexafluoropropylene) and oxygen, nitrogen, or noble gases (column 5, lines 65-68; column 6, lines 1-13). Babacz '723 discloses methods for treating particles with plasma activated species to functionalize, coat or graft the particles. There is absolutely no disclosure or suggestion

that the gaseous mixture would be an effective replacement for perfluoro compounds in a chamber cleaning gas to remove reaction byproducts from the walls of plasma CVD chambers of semiconductor integrated circuit production devices. Accordingly, it is believed that the rejection of the claims under 35 U.S.C. § 102(b) is inappropriate and should be withdrawn.

Claims 6, 7, and 10 were rejected under 35 U.S.C. 103(a) as being unpatentable over Gabric et al., U.S. Pat. No. 5,281,302 (hereinafter "Gabric '302), in view of Sony Corp., JP 04-346428. This rejection is respectfully traversed and reconsideration is requested for the reasons that follow.

Gabric '302 discloses a method for cleaning whereby an etching mixture is introduced into a reaction chamber, an ozone/oxygen mixture is added, and the etching gas mixture is excited to form a plasma having extremely low power with an excitation frequency in the RF range.

In contrast, the present invention is directed to cleaning gas suitable for use in production of semiconductors. The chamber cleaning gas of the invention removes reaction byproducts such as silicon, polysilicon, tungsten, titanium and their oxides, nitrides and carbides attached to walls of a plasma CVD chamber of a semiconductor integrated circuit production device.

Gabric '302 is completely unrelated to solving the problem of providing a cleaning gas with a much lower global warming potential than the previously known cleaning gases CF_4, C_2F_6, and SF_6, and suitable to remove reaction byproducts attached to walls of plasma CVD chambers of a semiconductor integrated circuit production devices.

Sony Corp. discloses a mixed gas containing unsaturated chain fluorocarbons and unsaturated cyclic fluorocarbons for use as an etching gas for dry etching silicon compound layers of semiconductor devices. As stated above, Gabric '302 discloses a method for cleaning wherein a gas mixture is excited to form a plasma. As such, it would not have been obvious to combine the teachings of Gabric '302 and Sony Corp. because plasma cleaning and dry etching are inherently inconsistent methods. Further, an etching technique for semiconductor devices and a cleaning technique to remove byproducts from the walls of CVD chambers are different processes and the appropriate gases for carrying out these techniques are different.

Gabric '302 only teaches CF_4 and C_2F_6 as chamber cleaning gases. Neither Gabric '302 nor Sony Corp., either alone or in combination, disclose or suggest that a chamber cleaning gas consisting only of unsaturated chain fluorocarbons would be effective as a chamber cleaning gas, only that a gas mixture consisting of two or all three of the following would be effective: CF_4/C_2F_6, unsaturated chain fluorocarbons, and unsaturated cyclic fluorocarbons. Thus, it would not have been obvious to have combined these teachings to achieve the present invention because the appropriate gases to carry out the inherently inconsistent methods of the references are different. Accordingly, it is believed that the rejection of the claims under 35 U.S.C. § 103(a) should be withdrawn.

In view of the foregoing, this application is in condition for immediate allowance.

If the examiner is of a differing opinion, he is invited to contact Applicants' attorney at the phone number below.

Respectfully submitted,

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ATTACHMENT A

Clean Replacement Paragraphs

At the following locations, replace the previously provided paragraph with the following clean paragraph(s).

Page 1, line 7

Perfluoro compounds such as CF_4, C_2F_6, C_4F_8 (perfluorocyclobutane) and SF_6 are used in large amounts as cleaning gases for plasma CVD chambers in production of semiconductors. Since the perfluoro compounds are stable and have long atmospheric lifetimes and high infrared absorbency, they have extremely high global warming potential (GWP) as compared with carbonic acid gas. CF_4 is 6300 times, C_2F_6 is 1250 times, C_4F_8 is 9100 times and SF_6 is 24900 times as high as carbonic acid gas in GWP. Therefore, development of a substitute gas having a low global warming potential is an urgent task.

Page 3, line 5

All the three kinds of chamber cleaning gases of the invention have satisfactory levels of properties so that they can be used as substitutes for conventionally used chamber cleaning gases, namely, CF_4, C_2F_6 and SF_6. Moreover, the gases of the invention have much lower global warming potential than CF_4, C_2F_6 and SF_6.

ATTACHMENT B

Marked Up Replacement Paragraphs

At the following locations, a marked up copy of the replaced paragraph is provided.

Page 1, line 7

Perfluoro compounds such as CF_4, C_2F_6, C_4F_8 (perfluorocyclobutane) and SF_6 are used in large amounts as cleaning gases for plasma CVD chambers in production of semiconductors. Since the perfluoro compounds are stable and have long [atomospheric] atmospheric lifetimes and high infrared absorbency, they have extremely high global warming potential (GWP) as compared with carbonic acid gas. CF_4 is 6300 times, C_2F_6 is 1250 times, C_4F_8 is 9100 times and SF_6 is 24900 times as high as carbonic acid gas in GWP. Therefore, development of a substitute gas having a low global warming potential is an urgent task.

Page 3, line 5

All the three kinds of chamber cleaning gases of the invention have satisfactory levels of properties so that they can be used as substitutes for conventionally used chamber cleaning [gasses] gases, namely, CF_4, C_2F_6 and SF_6. Moreover, the gases of the invention have much lower global warming potential than CF_4, C_2F_6 and SF_6.

ATTACHMENT C

Clean Replacement/New Claims

Following herewith is a clean copy of the introductory phrase to the claims.

Page 5, line 1

What is claimed is:

B2

ATTACHMENT D

Marked Up Replacement Claims

Following herewith is a marked up copy of the introductory phrase to the claims.

Page 5, line 1

[CLAIMS] What is claimed is: